The Measurement of Productivity Growth for Interstate Access Services

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The Commission has asked whether there is a valid distinction between interstate and intrastate productivity in the calculation of the Total Factor Productivity (TFP) index for the Local Exchange Carriers, and whether a satisfactory method of accounting for this difference exists. Two different positions have been taken on this issue. Christensen Associates and USTA on behalf of the LEC industry take the position that any attempt to reach a conclusion regarding the effect on overall TFP growth of a single output in a multiproduct firm with joint or common inputs requires an arbitrary assumption on allocating common costs. Assertions about estimating output or service specific total productivity growth rates in such a context are erroneous. The appropriate measure for calculating the price cap formula is the company level and not the specific interstate access services total productivity growth rate. The position of AT&T is that failure to

recognize the increasing contribution of the substantially higher growth rate of interstate output to productivity growth is a mistake. The productivity measure suggested by Christensen and USTA ignores the contribution of the rapid growth in interstate access services, which with its inherent economies of scale and technological advancement, is the major source of total factor productivity growth of LECs. Using total company TFP growth will create a severe bias in the FCC's calculation of productivity results and therefore understate the LECs' X-Factor for interstate access services. This understatement of productivity growth will increase the interstate access price at a faster rate than costs, leading to the windfall earnings growth of LECs and will impose a burden on buyers of interstate services through increased prices.

AT&T's position is substantiated by Dr. J.R. Norsworthy's study of the LEC's productivity growth.[2] Table 7, page 28, of their statement, sets out the numerical calculation of TFP growth rates for interstate access services and all other regulated LECs' services. The difference between these growth rates over the period 1985 to 1994 is substantial. The average TFP growth rate for the LECs' interstate access services is more than 65% higher than for the total LECs' regulated services. Since the FCC price cap regulation applies only to interstate access services, the

[2] Appendix A, AT&T's Comments, Fourth FNPRM, FCC Docket 94-1.

measurement of the X-Factor will be affected by whether the company or the interstate total factor productivity growth rate is used in the calculation.

The important issue here is whether the cost structure of the LECs is joint and common, i.e. whether the separate estimate of interstate TFP growth is economically meaningful. There are essentially two ways to address this issue. One is to assemble evidence based on engineering and institutional practices and to use reasonable assumptions to approximate separate TFP growth measures for interstate access and other regulated services of LECs. The other approach is to use econometric techniques to estimate the underlying cost structure of the LECs' production of various types of services and to test the jointness of cost structure. I examine each of these options. The alternative approach to the econometric estimation is to assemble evidence from observed data, technological aspects of the network that provides interstate and intrastate access services, management practices and the legal requirements of the FCC governing jurisdictional cost allocation rules. Some of the relevant issues are discussed below:

A. Growing Demand and Declining Unit Costs for Interstate Access Services

The growth rates for various services provided by the LECs exhibit very different growth patterns. Demand for interstate switched access minutes has been growing at a rate of about 10% while demand for subscriber lines has grown by about 3% and Dial Equipment Minutes (DEMs) have grown about 3.7%. Therefore, differential growth rates in demand for various services have different effects on the LECs productivity growth and their relative contributions need to be recognized. In fact, Christensen in his statement of August 17, 1995, clearly shows how much a potential decrease in growth of demand for intraLATA toll and switched access could affect Pacific Bell's productivity growth.[3] Thus in addition to the growth of aggregate output, the sources of aggregate output growth can be an important determinant of TFP growth. When the markup of price relative to marginal cost varies over the services provided, growth in services with high markup contributes more to the TFP growth than the growth in services with low markup. The interstate access services have high markup over their costs, as Norsworthy's discussion of the interstate access measurement issue shows. Thus, these services make a higher

[3] L.R. Christensen, P.E. Schoech, and M.B. Meitzen, "The Relationship Between Output Growth and Productivity Growth for Telephone Local Exchange Carriers" mimeo, August 17, 1995.

contribution to the TFP growth of the LECs and requires special consideration.

The interstate and other LECs services follow different production processes with different labor, capital and materials input requirements. The rates of technological advancement embedded in the equipment used in providing of interstate and other services are quite different. Local telephone services involve relatively high labor costs and have experienced only modest technological change. Interstate access services (local and toll calling switched services), on the other hand, have been the beneficiary of more rapid growth of technological advancement. These technological advancements have been centered mainly in the digital switching, signaling system and advanced network intelligencies. These technologies require very little labor and material inputs to operate.

There are several reasons why TFP growth is likely to be greater for the LECs' interstate services than for their intrastate services. The difference in TFP between the two types of service arises from the different mix of services between the two jurisdictions and the underlying network functions required by these services. The network functions underlying interstate access services consist mainly of interoffice transport,

switching, and signaling. Additional network functions include the portion of the subscriber line that is assigned to interstate and the high capacity lines ("entrance facilities") that connect IXC POPs to the LECs' serving wire centers. There are a number of reasons to expect that the mix of services in the interstate jurisdiction is experiencing greater productivity growth than the mix of services regulated at the state level. The network functions are characterized by significant economies of scale. Modern transmission and switching systems are both characterized by substantial fixed costs, with relatively low incremental costs for augmenting capacity. The transmission, switching, and signaling functions that make up interstate access are highly capital intensive and have benefited the most from technological innovations, and require minimal labor input on an ongoing basis. LECs' intrastate services have also benefited from these developments, but to a lesser degree. The major network function associated with the LECs' intrastate business consists of the local loop, where productivity growth has been far less dramatic. Subscriber access lines involve a highly stable technology (copper loops) and exhibit a relatively high labor component for installation, maintenance, and customer service functions. Growth of subscriber lines has been relatively slow, and the growth that does exist typically involves extending services to new neighborhoods and buildings, an activity characterized by few economies of scale.

The increased efficiency of switched access services can also be inferred from the estimates of cost elasticities for toll and local services reported in the economic literature. Although the toll and local services do not perfectly map to interstate and intrastate services, in general, the interstate services are costly toll service in nature while the intrastate services are of the local service type. Using the Canadian telecommunications data, Bernstein (1989) and Denny, Fuss and Waverman (1981) reported the estimated cost elasticity of toll and local services for the period from 1955 to 1976/78. According to the Bernstein study, the estimated average variable cost elasticity of toll service was 0.0599 and that of local services was 1.2304 for the period 1955-78. Denny, Fuss and Waverman's study (1981) reported on average the cost elasticity of toll service as 0.0950 and that of local service as 0.5790 for the period 1955-76. Using U.S. telecommunications data, Nadiri and Nandi (1995) obtained a preliminary result based on the estimated cost function of the U.S. telecommunications industry which shows that the cost elasticity of toll service is significantly lower than that of local services during the same period as mentioned above, and cost elasticity of toll service declined faster than that of local service from the

beginning of 1980's.[4] These econometric estimates of cost elasticities of toll and local services indirectly imply lower costs and increasing efficiency gains in the provision of interstate access services than that experienced by other services of LECs at the state level. The conclusion that can be drawn from this observations is that the growth of demand for interstate access services over the period 1985-1994 has been high and that these services have experienced a sizable decline in costs due to inherent product specific economies of scale and technological advancement. That is, the input requirement for producing these services has declined substantially, compared to what they would have been if provision of interstate access service had not benefited from rapid technical progress and economies of scale. The evidence points to a higher productivity growth rate for interstate access services than for other regulated services provided by the LECs.

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[4] Denny, M., Fuss, M. and Leonard Waverman, 1981, " The measurement and interpretation of total factor productivity in regulated industries, with an application to Canadian telecommunications" , in "Productivity Measurement in Regulated Industries", pp. 179-217. Bernstein, J. I., 1989, " An examination of the equilibrium specification and structure of production for Canadian telecommunications" Journal of Applied Econometrics, vol 4, pp. 265-282, Nadiri, M. I. and B. Nandi, 1995, " The changing structure of Cost and Demand for the U.S. Telecommunications Industry", an unpublished memo presented in the 1995 ITS conference in France.

B. Interstate Access Service Productivity Growth

The FCC has had a long standing practice of identifying and allocating investment and operating costs between interstate and intrastate jurisdictions. The very nature of this practice implies calculating separate TFP growth rates for interstate access and other services provided by LECs. While the jurisdictional cost requirements remain in force and must be followed by the LECs as a matter of law, an allocation principle is already in place. One can raise the issue of whether or not the FCC's jurisdictional allocation rules reflect optimal allocation of costs. However, in the absence of definitive econometric evidence, the FCC allocation rule can be considered as a first order approximation. In fact it is clear that the FCC jurisdictional cost separation requirements may be biased against interstate access services. As an illustration, a study by NYNEX in 1993 showed that the separations rules overallocate approximately $1 billion in costs to the interstate jurisdiction, primarily to the switched access categories of local switching, local transport, and Carrier Common Line.[5] If so, the calculated TFP measure for interstate

[5] NYNEX undertook this study to identify the costs associated with the major categories of state and interstate services and to compare the results with the costs allocated by the Part 36 Separation and Part 69 Access charge rules. The NY cost study is based on embedded direct costing guidelines that were approved by the NY-PSC. According to NYNEX, it produces a more accurate calculation of the cost of services, on a fully-distributed basis, than is produced by the FCC's Separation and Access charge rules.

access services will be lower than its "true" measure. The evidence from the jurisdictional association of costs with outputs shows that interstate inputs have grown more slowly than intrastate inputs, which supports the use of total company input growth as an upper bound of interstate input growth.

The productivity estimates for interstate total factor productivity growth submitted by AT&T takes into consideration the following important issues. First, interstate access services rely more on fixed inputs and have been experiencing substantial improvement in the technology embedded in various types of equipment used in producing interstate access services. Second, the growth rate of interstate access services have been very rapid in the past several years and its contribution to TFP growth should be acknowledged in pricing interstate access services.

AT&T takes a reasonable approach toward measuring TFP growth for interstate access services in its Performance Based Model. The methodology of calculating separate TFP growth for interstate access and other services is straight-forward. Given the growth rates of different types of services, it is assumed that all inputs for both interstate and other services grow at the same rate. Given this assumption about input increase which the jurisdictional cost and revenue data shown to be

conservative, the difference between the productivity growth rates of interstate and other services are estimated to be quite substantial. The average TFP growth rates for interstate access services is higher by almost 65% than for other LECs' services. The difference would have been even higher if a less generous growth rate for inputs were used in the calculation of interstate TFP growth. Given the description of the technological advancement and the inherent economies of scale in provisioning of interstate access services, allowing its costs to rise by the same rate as those for other services is certainly generous. It may definitely exceed the needed inputs requirements for producing efficiently a given level of interstate services. Therefore, the AT&T's procedure, by adopting an upper bound for input increase permits calculating a lower bound for the productivity growth in interstate access services. In light of the conservative assumptions of input growth, the technological advances in the industry, the cost behavior of the interstate access services and the procedures governing the cost allocation required by the FCC, AT&T's approach to measuring the productivity growth of the interstate access services is reasonable.

C. The Econometric Approach

The econometric approach for estimating multiproduct cost function is well developed in the econometric literature. However, there are several difficulties with this approach as it may be applied to the LECs. The proper test to prove the case for or against jointness in production is difficult to carry out. To test global jointness of production (or global economies of scope) requires knowledge of stand-alone costs for each output. If there are two outputs and if the data set contains firms that offer each output separately as well as firms that offer both outputs, then it would be possible to test the economies of scope globally. There are no companies of significant size, however, that offer only local services or only access to local customers to the interexchange carriers. Historical data therefore do not exist for a global test of joint production.

A less stringent approach would be to test for local cost complementarity. This test can be carried out by estimating the cost function of the LECs as that of a multiproduct firm. Cost complementarity exists when an increase (decrease) in the level of one output causes the marginal cost of the other output to decline (increase). If the degree of cost complementarity between the two services is zero or constant over the

range of the two services produced, then their costs are not joint and separate TFP growth rates can be calculated for each service.

To perform this test in a completely dynamic framework would also require hedonic adjustment of inputs that experience significant quality change over the period of observation, especially the capital input, and explicit modeling of the costs of adjustment to changing levels of output demand and changing technology of production. In order for the test for jointness to be valid, the model would have to adjust for all factors that might substantially affect the relationships among the outputs, and between the inputs and the outputs. Developing the data to capture these effects would be a major task for an industry as dynamic as telecommunications. A well defined econometric model to test the local cost complementarity hypothesis therefore can in principle be designed and tested. However, such an undertaking may not be easy to carry out. It will be a fairly time consuming undertaking. More importantly, the results are likely to be contested on technical grounds and their relevance will be questioned. In summary, the econometric approach could offer some advantages in better understanding the structure of costs in the local telephone industry, but the prospects for implementing a satisfactory model at this time appear remote.

CERTIFICATE OF SERVICE

I, James P. Young, do hereby certify that on this 1st day of March, 1996, a copy of the foregoing "Reply Comments of AT&T," together with the attached Appendices, were mailed by U.S. first class mail, postage prepaid, to the parties listed on the attached Service List.

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